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The Ups and Downs of Regional Income Convergence in Europe. Evidence from a Cross-Section and a Cross-Section Time Series Analysis

GABRIELE TONDL

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Abstract:

The paper provides an assessment of the regional convergence process between the Western European regions since the 1950s. Two sets of issues are addressed: (a) Is there sufficient evidence of regional convergence? If so, has the speed of convergence changed over time and is this speed satisfactory. (b) Is convergence a phenomenon limited to the core EC regions as often claimed or did it encompass Europe's Southern and Northern regions as well? The investigation follows the methodology suggested by Barro and Sala-i-Martin to study the process of convergence in a neo-classical model of growth and to assess its speed. In contrast to the results obtained we then put an estimation of convergence based on panel data techniques, which shows the size of individual regional effects determining steady state income. The results suggest that convergence had set in at a rather high rate during the fifties and sixties. European regions seemed to have joined on a common convergence path until 1973. After 1975, convergence slowed down distinctly and several poorer regions on the Southern periphery started to show a weakness in convergence. Slow convergence in the 1980s was paired with an increasing deviation in steady state income between rich and poor regions, which a number of the latter could not recover when convergence set in again in the late 1980s.

1. Introduction

Assistance for regional development has become a major policy area of the European Union. This reflects the fact that regional income inequalities existed in the early period of EU integration and have increased as new, less prosperous members have joined the Union. The EU´s regional policy has, however, not remained free of criticism. One argument put forward is that growth dynamics act in favour of a decrease in income disparities, and thus this high-cost policy could be renounced.

Therefore, it is of special interest to see how regional income disparities have changed over the past period. Can we observe a diminishing of regional income dispersion in Western Europe? Did poor regions of the past catch up with wealthier ones? Is the speed of catching-up satisfactory and has it changed over time and across different parts of Europe? These questions can be addressed, independently of the question of the impact of EU-regional policy itself.

The paper will investigate the development of regional per capita income disparities in Western Europe over the past forty years. The main issue is whether a process of convergence, i.e. higher growth in initially poor regions than in rich ones, manifested itself during this rather long period and how fast convergence has taken place. As higher economic integration is considered to foster convergence between its partners, we would expect that income disparities have declined more between the core members of the European Union than between regions outside and the one inside.

The investigation will follow in many parts the methodology introduced by Barro and Sala-i-Martin (1990, 1991) to study the process of convergence in a neo-classical model of growth and to assess its speed. In contrast to the results obtained we then put an estimation of convergence based on panel data techniques, which shows the size of individual regional effects determining steady state income. Finally, we show how the distribution of regional incomes in Western Europe has changed as a result of the convergence process and at which extent regions could switch their rank position in income level.

This study goes beyond the scope of existing works on regional convergence in the EU in several respects. It covers the development of regions from practically all Western European countries for the period from 1960 to 1994, and for the core European member states it goes back to 1950. So far convergence has not been analyzed for this complete set of European regions over such a long period. The paper also investigates differences of regional convergence between various parts of Western Europe and distinguishes between early European

Community members, the Southern European later entrants, and the EFTA countries. The existing literature on regional convergence in Europe has mainly focused on an incomplete set of EU regions, and, furthermore, has only partly considered the development of EU´s poorer regions.

The paper comes to several interesting conclusions with respect to the timing and geographical coverage of the convergence process. Regional convergence set in at the common benchmark speed of 2 per cent among the core European Community regions and was particularly pronounced between them in the first part of the 1960s and the period following, up to 1973. From the mid-sixties until 1973, convergence comprised all European regions. Regions outside the European Community exhibited strong convergence with those inside. Since the mid-seventies convergence has slowed down to half of the previous speed. From 1975 to 1980 it was practically equal between the regions of the Community and between all European regions together. However, both EFTA regions and regions of the Southern countries started to show strong intra-group convergence, which ended among the Southern regions with complete integration into the EC. During the first half of the 1980s, regional convergence was virtually non-existent. If it did exist, then it existed between the European Community regions. For the whole group of European regions divergence had rather occurred between 1980 and 1986 than convergence. Moreover, during this period club-convergence appeared and differences in individual steady state income became more pronounced than before. Since 1986, regional convergence set in again on a global scale and thus weakened the evidence for club-convergence. However, some of EU-12´s Southern regions have been rather excluded from the latest convergence process and seem to be locked in a low steady state income position. It is also evident that regional convergence has been higher between the Northern EC regions and EFTA regions since 1975 than between the Northern EC regions and the Southern regions. We may conclude that EC integration partly has enhanced regional convergence among its members. Sometimes this effect set in with a long delay. On the other hand, EFTA regions reached a high degree of economic integration with EC members - even without being members of the Community -, which fostered convergence. Finally, we have to realise that, although the evidence suggests that regional convergence takes place, this process is very slow. Under considerations of a more equal welfare distribution in the European Union, this is not very satisfactory.

The paper is organized as follows: In section 2 the theoretical framework of convergence analysis is described, stressing the concepts of β-convergence and σ-convergence. Section 3 gives an overview of the results of existing studies on European regional convergence. Section 4 presents our analyses for regional

convergence. After providing some stylized facts on the development of regional income disparities in Europe, first the estimates obtained by a cross-section regression, covering the whole period, are presented in section 4.3., then the results from panel data estimation for the period 1975-1994 are described in section 4.4. Section 5 gives the conclusions and points to further issues for research.

2. The theoretical framework of convergence analysis

2.1. A definition of convergence: σ-convergence and β-convergence

First, we would like to give a definition of convergence which will be relevant throughout the rest of this paper. As most commonly accepted, convergence is encountered in two basic concepts: σ-convergence and β-convergence. σ-convergence refers to the reduction in dispersion of per capita income or output within a set of regions or countries over time. In contrast, β-convergence is given if poor economies grow faster than richer ones, i.e. if regions with low initial per capita incomes exhibit higher growth rates than regions with high incomes. One can indicate the magnitude of β, i.e. the speed of convergence, for a set of economies within a period. If β is positive and high, poorer economies are faster converging to a common steady state per capita income level than if it is low. The two concepts are linked to each other in the way that β-convergence is a necessary, although not sufficient, condition for σ-convergence. In other words, σ-convergence - a reduction in income dispersion - will only occur if poor economies start to grow faster than rich ones. However, it is important to note that higher growth rates of poorer economies and slower growth of rich ones do not necessarily mean that income disparities in the whole set have diminished, although the initially poor are better off now and the initially rich have not gained as much as before. Finally, the dispersion of incomes also remains equal if no β-convergence occurs. Hence both concepts of convergence are relevant for empirical research on the development of income disparities in a set of regions.

It is widely accepted to address the issue of convergence or divergence from the point of view of development of per capita income differences. Clearly, this indicator is adequate to capture differences in welfare across regions. Nevertheless, convergence in other variables, most obviously unemployment, would be an interesting, complementary point of study.

2.2. The theoretical background of convergence analysis: Dynamics in the neo-classical model of growth

The concept of β-convergence has its roots in the neo-classical model of growth (Solow and Swan 1956). In this model - in the most simple version - output Y at time t is a function of the variables physical capital K(t) and labour L(t) and the level of technological progress A(t), which is exogenous. This can be written in the form of the following equation:

$$Y(t)= A(t)\, K(t)^{\alpha} L(t)^{1-\alpha} \qquad \text{with } 0 < \alpha < 1 \qquad (1)$$

For a given level of technological progress A(t) , the output in time t depends on the amount of capital and labour. The saving rate s is assumed to be exogenous and constant.[1]

The main characteristics of the neo-classical production function are thus constant returns to scale (given by the sum of coefficients equal to 1) and diminishing marginal products of the production factors K and L. Hence, for a given level of technological progress, for a given labour force and saving rate, additional amounts of capital will yield decreasing rates of return, and therefore decreasing growth rates, until, finally, the economy has reached a constant steady state output growth rate, equivalent to population growth.

In per capita terms, in the steady state, both the stock of capital per person k* and output per capita y* do not change. The growth rate of y and k is zero in the steady state.

$$y^* = f(k^*) \qquad (2)$$

The steady state income y* is above all determined by the rate of technological progress A at time t, assumed to be exogenous and to which all economies have free access.[2] The central prediction of the neo-classical model of growth is that, all other things being equal, the growth of per capita income falls with the accumulation of capital. In the longer term, per capita income can only rise when important improvements in the technological level are introduced, which

[1] This assumption can be released (Cass 1965, Koopmans 1965), but is kept here to ease demonstration of the convergence mechanism. One may also think of capital in a broader sense, comprising physical and human capital (Mankiw, Romer and Weil 1992).

[2] The argument of equal access to available technology or fast technological diffusion can be considered to be valid for highly open economies with a similar level of basic education in the population. This may be expected for the group of advanced economies in general, and in our case for the regions in Western Europe.

would lead to an upraise in steady state income. In addition, shifts of the steady state income will also occur if other factors, which enter into the model, change, i.e. if the saving rate rises, or population grows at a higher rate.

In contrast to the neo-classical growth theory, the new growth theory (Romer 1986, Lucas 1988, Grossman and Helpman 1991), contests the growth dynamics of the former theory and its assumptions of easy access to technology. Inspired by the fact that on a world-wide scale high income countries remained ahead in growth, it argued that the technological level of an economy is determined endogenously by the rate of investment in human capital. Its accumulation would exhibit increasing returns rather than decreasing, which thus would imply sustainable rates of growth. As a consequence, new growth theory cannot explain the dynamics of convergence. The convergence analysis therefore relies on the framework of neo-classical growth theory. A failure to prove convergence in a specific empirical context would then suggest that the assumptions of new growth theory are more relevant in this case.

2.3. Absolute convergence and conditional convergence

If we imagine a set of economies with the same steady state per capita income and which only differ in their initial capital endowment per person and per capita income, the neo-classical model of growth would predict β-convergence, i.e. poorer economies will grow faster than richer ones in a transition period until they have converged towards the same per capita income.

This kind of convergence is referred to as *absolute convergence* (Barro and Sala-i-Martin 1991, 1995; Sala-i-Martin 1996, see also de la Fuente 1995, Galor 1996, Seidel 1995). It requires the assumption of a unique steady state, which is satisfied if technology, the saving rate, population growth and depreciation are equal across the set. Absolute convergence only considers different initial capital ratios between rich and poor economies.

On the contrary, if differences in other fundamentals are considered, and hence different steady states are captured, neo-classical growth theory invokes the concept of *conditional convergence*. Regarding a large set of inhomogenous economies, e.g. all economies of the world, it is obvious that their fundamentals are not the same, as assumed in the concept of absolute convergence. Differences in a variety of factors, e.g. in the technological level, in the saving ratio, in economic structures, in the level of education, in government policies and in preferences, will imply that economies or groups of economies have different steady state incomes. For example, those countries with a high level of education in the labour force will have a higher steady state income than those

with a low educational level. Similarly, countries with a higher saving ratio have a higher steady state income than those with a low one.[3]

2.4. Methods in empirical convergence analyses

The empirical analysis which aims to prove whether absolute convergence exists within a group of economies (Barro and Sala-i-Martin 1995:31) investigates whether the following relation holds true:

$$\log (y_{it} / y_{i,t-1}) = a - b \cdot \log (y_{i,t-1}) + u_{it} \qquad (3)$$

The equation states that the annual growth rate of per capita income of economy i between time t and time t-1, $\log (y_{it} / y_{i,t-1})$ is inversely related to the per capita income in time t-1, also expressed as a logarithm, $\log (y_{i,t-1})$; a and b are constants, and u_{it} is a disturbance term. The parameter b captures the relationship to be tested, and it is defined to take a value $0 < b < 1$. If $b > 0$, the sample exhibits β-convergence, the tendency of convergence will be greater, the higher is the value of b. (Barro and Sala-i-Martin 1995: 31, Sala-i-Martin 1996: 1020)

The existence of such a process of convergence has been proved for a set of countries which have fairly similar structures and can therefore be expected to have very similar steady state per capita incomes. In their pioneering work, Barro and Sala-i-Martin (1991, 1992) have shown that in fact economies which can be expected to be very similar in their fundamentals, such as the US states or the OECD economies, exhibit this kind of convergence.

One can also calculate a direct measure of the *speed of convergence*, i.e. how fast economies will converge towards the steady state.

If for a set of economies i the development of per capita output y_i is regarded for a period of time of length T, where y_{i0} denotes per capita income at the beginning of the period, and y_{iT} at the end of the period, then the following equation captures β-convergence and also yields a direct estimate of the speed of convergence, denoted as β (Barro and Sala-i-Martin 1995: 81).

[3] The concept of conditional convergence, which encompasses the existence of multiple steady states, can also explain the phenomenon of club-convergence (Galor 1996). This refers to the situation where richer economies convergence towards a high level of income, whereas poor economies converge towards a lower income level (Ben-David 1994). If the difference in steady state of the two is caused, e.g. by different endowment with human capital, poorer economies will remain inside the low-income club unless a substantial rise in their human capital would raise their steady state income.

$$1/T \cdot \log (y_{iT} / y_{i0}) = x + (1- e^{- \beta T})/T \cdot \log(y^* / y_{i0}) + u_{i0T} \quad (4)$$

The left hand term of the equation $1/T \cdot \log (y_{iT} / y_{i0})$ indicates the average annual growth rate of per capita output during the period T. The steady state growth rate is x, the term $\log(y^* / y_{i0})$ indicates the distance of the per capita income of economy i from the common steady state income y*. The coefficient $(1- e^{- \beta T})/T$ which relates the growth rates of y_i to its gap from steady state declines with the length of T for a given β. It captures the fact that growth rates will decline as income increases. If T goes to infinity the steady state growth rate will dominate. Thus, if the interval T investigated is longer, the coefficient assures that the effect of the initial income position on average growth rates declines. Barro and Sala-i-Martin (1995: 387) suggest this equation in order to obtain comparable indicators of β regardless of the interval of time selected.

In practice, a common steady state is assumed, but its exact value is not known. Therefore, one defines a constant $a \equiv x + [(1 - e^{-\beta T})/T] \cdot \log (y^*)$ and rewrites equation (4) in the following form, better suited for estimation:

$$1/T \cdot \log (y_{iT} / y_{i0}) = a - (1- e^{- \beta T})/T \cdot \log(y_{i0}) + u_{i0T} \quad (5)$$

The intercept a should therefore be understood to reflect the sample´s steady state income. A value of β of 0.02 per year, the benchmark detected by Barro and Sala-i-Martin (1990, 1991) for the convergence of the US states, means that it takes 35 years until an economy has closed half of its income gap (Barro and Sala-i-Martin 1995: 37, Seidel 1995).

For the estimation of conditional convergence, the following equation is applied (Sala-i-Martin 1996), which includes variables that can proxy for differences in steady state:

$$1/T \cdot \log (y_{iT} / y_{i0}) = a - (1- e^{- \beta T})/T \cdot \log(y_{i0}) + \psi \mathbf{X}_{i0} + u_{i0T} \quad (6)$$

where the left-hand term indicates the average annual growth rate of per capita output during the period T, $\log (y_{i0})$ is the initial per capita income, a is a constant, β is the rate of convergence and $\mathbf{X}_{i0}$ is a vector of variables which conditions the steady state, u_{i0T} is the disturbance term. When estimating for conditional convergence, one therefore wishes to prove whether a set exhibits convergence under the condition of differences in steady state considered by a set of conditioning variables $\mathbf{X}_{i0}$. Among the large number of variables tested in empirical studies, human capital (Barro 1991), the investment share, and the

foreign trade ratio (Levine and Renelt 1992) were identified as most significant factors determining steady state differences. Regional convergence studies conferred to single countries have considered the importance of such conditioning variable as well (for Spain: de la Fuente et al.1994; Garcia-Mila and Marimon 1995; de la Fuente 1996; for Italy: Paci and Pigliaru 1995; for Germany: Herz and Röger 1996). However, regional convergence analysis across a large set of countries, which we cover in this paper, meets considerable difficulties to employ identically defined statistical data that would be required to include conditioning variables. Therefore, one is largely restricted to use country dummy variables or regional dummy variables in order to account for differences in steady incomes. Finally, one should be aware that verification of β-convergence in the case of multiple steady states does not necessarily lead to a decline in cross-regional income dispersion, but it tells us that economies exhibit the automatic dynamics suggested by neo-classical growth theory, which are necessary to reduce income disparities. [4]

3. The results of previous empirical research on European regional convergence

So far, empirical studies on regional convergence in the EU have concentrated on the EU-12 regions during the 1980s. Investigations for the previous decades are confined to the convergence process *within* the Northern EU member states. In a less analytical way, some studies have also traced the change in the relative income position of EU-9 regions since the early years of the European Integration.

The convergence of the European Union regions in the sense of β-convergence has first been investigated by Barro and Sala-i-Martin (1991, 1995). However, their study did not consider convergence with respect to the EU per capita income, but rather *within* member states. They also confined their analysis to the Northern EU member states and Spain as the only cohesion country. Consequently, a set of studies on regional convergence in the EU have followed. Neven and Gouyette (1994) investigated ß-convergence for all NUTS II level EU-regions for the period 1980-89, regarding the development of relative per capita income (income in terms of the EU-average). Button and

[4] The fact that β-convergence does not necessarily result in diminishing income dispersion was picked up by Quah (1993), who pointed out its analogy with Galton´s classical fallacy and raised his objections that this kind of convergence analysis were misleading. However, we consider if the point of interference of both concepts is kept in mind and complementary analysis of the evolution of income distribution are provided, the analysis of β-convergence is a useful tool to study convergence.

Pentecost (1994) analyzed ß-convergence for a longer period starting in 1975, but regarding only NUTS I level regions from the former 9 EC member states. Renouncing the framework of β-convergence, Quah (1996) investigated regional income distribution dynamics of NUTS II level regions in the eighties, but from 6 member states only, among which Spain and Italy. Canova and Marcet (1995) study convergence of NUTS II level regions from 9 member states for the period 1980-92, using a theoretical approach which emphasizes on the path of a region to its own steady state income.

Besides the above studies, which attempt to find a proof or discard of the neo-classical convergence concept, several other studies have focused the development of dispersion of per capita GDP, i.e. σ-convergence, in the European Union. One of the first to raise the topic were Molle, van Holst and Smit (1980), who looked at the evolution of regional per capita income disparities of the initial 9 EC-member states during the period 1950 to 1970. More recently, Leonardi (1995) presented a study, which stressed the change of a region´s relative per capita income, measured by the change in the index position with respect to the average EU per capita income.

In their first analysis of convergence of EU regions, Barro and Sala i-Martin (1991) detect ß-convergence *within* the Northern EU member states (Ireland excluded from the sample) of about 1.8 per cent per year for the period 1960-1985. In their second study, regarding regional convergence between 1950 to 1990 *within* 8 EU member states, among which the 1973 members - without Ireland - and the later entrant Spain, Barro and Sala-i-Martin (1995) also find a ß-convergence of about 2 per cent annually for the whole set. Convergence was highest in the 1960s with 2.3 per cent and became very slow in the 1980s, dropping to one per cent (Barro and Sala-i-Martin 1995: 398-9). However, these results of convergence should be considered as the average speed of convergence, when each country´s regions converge to the country mean. The results are not comparable with cross-country regional convergence. Sala-i-Martin (1996: 1024) shows that the convergence rate differs considerably within selected European countries: In the period 1950 to 1990 convergence was fastest in the UK with 3 per cent, but much slower within Germany (1.6 per cent), France (1.4 per cent), Italy (1 per cent) and Spain (0.7 per cent). For the period 1980-1989, Neven and Gouyette (1994: 11) find a similar rate of ß-convergence of 1.1 per cent among the EU-12 regions, if country-specific differences in steady state income are accounted for. They conclude that during the first part of the decade a strong catching-up of Southern regions among themselves existed, whereas in the second part, convergence occurred mainly among the Northern regions. Button and Pentecost (1994) report evidence of convergence among regions from the Northern member states, but the

specification of their estimated coefficient does not permit comparison with results from the above studies.

Quah (1996a) shows that the distribution of regional per capita income of 6 member states had its peak below the average value throughout the eighties. A convergence cluster appeared on the upper limit of the income distribution, more pronounced in the first part of the eighties than in the second one. On the lower end of the distribution a convergence cluster had existed during the first half of the eighties.

Canova and Marcet (1995), in the framework of a distinctly different methodological concept, find that EU regions converged to their own steady states at a rate of 23 per cent on the average.[5] Rates of convergence to the own steady state varied from low rates in the North of France, as well as in some parts of the Netherlands and the UK, to 80 per cent in the North of Portugal and some regions in Greece. However they find that steady state incomes were rather different among EU regions. For most regions steady states showed a close relation with their initial income position, i.e. poor regions have a lower steady state income and one should not expect that income disparities would decrease.

Leonardi (1995) considers that regional convergence has been strongly present in the European Community, however without building his conclusion on a formal definition of convergence. Leonardi rather considers that the upward movement of the poorest regions in GDP p.c. index and the diminution between the highest and the lowest index scores indicate convergence. Comparing the GDP p.c. index of EC-9 regions at the beginning and the end of the two 20 year periods 1950-1970 and 1970-1991, he concludes that convergence has taken place. In the case of the Southern countries´ regions, he considers upward movements in index score, given for a number of regions, as an evidence for convergence. Certainly this interpretation of convergence is misleading and simplifies the uneven pattern of the European regions´ convergence process.

[5] The authors model relative per capita income y_{it} of economy i at time t by the equation: $y_{it} = a_i + \rho_i y_{it-1} + \varepsilon_{it}$, where a_i is a specific constant for economy i and ε_{it} are the residuals. The steady state income of economy i then is $a_i / (1- \rho_i)$ and $(1- \rho_i)$ is the speed of convergence towards this steady state (Canova and Marcet 1995: 9 seq.). For estimation, the authors use a Baysian model with panel data, including observations for several points in time for each economy (in contrast to the conventional cross-section regression procedure which regards a single period mean growth rate and initial income).

In contrast to previous works, which either focused on a few EC member states or on a short period of time, our investigation will provide an assessment of the convergence process regarding all NUTS II level regions of the 12 EC member states, of the new entrants of 1995, and Norway over the period from 1960 to 1994. For the EC-9 members this is done also for the 1950s. We will look at differences in regional convergence between different groups of countries, i.e. the early 9 members of the European Community, the EFTA countries and the Southern cohesion countries. As these groups participated in the European integration process at a different extent, it will be interesting to see whether this has led to differences in convergence across Europe. Hence, we may raise the question: Did non-integration impede the catching-up of the cohesion countries and EFTA countries to European income levels?

4. The investigation: Looking at regional convergence in Western Europe during the past 40 years

The centre-point of this investigation is to provide an assessment of the speed of β-convergence in a cross-section analysis. This is done for a sequence of periods from 1950 up to 1994 (part 4.3.). As the results of the cross-section analysis provided little insight into the weak convergence process of the 1980s, and as we could exploit annual data for that period, a panel data estimation was added, which could account for the single region-specific effects in convergence (part 4.4.).

4.1. The data set of the investigation

We will analyze regional convergence in Western Europe using three different data sets separately[6]:

- For the investigation of European regional convergence in the 1950s, we use data provided in Molle et al. (1980), which gives regional gross value added for the 8 initial EC member states, referring to the NUTS I level, in the case of Italy and France to the NUTS II level. The data provides two observations of gross value added for each region, relating to 1950 and to 1960.[7]

[6] Other studies sometimes mix data from various data sets, which raises the problem of data inconsistency.

[7] The data contained in Molle et al. has the inconvenience that it reports GVA p.c. at current exchange rates in US-$ and provides figures on growth of GVA p.c. computed by using the Western European consumer price index. This is less problematic for the period for which we extracted data from this source as exchange rates were rather stable in the 1950s and inflation rates did not much differ across European countries (see IMF, Financial statistics yearbook).

- For the convergence analysis for the period 1960-1973, we use data compiled by Vandermotten[8], which contains regional GDP p.c. relative to the Western European average[9] on the NUTS II level for the 8 initial EC members and, in addition, for Spain, the Scandinavian countries and Austria. We use the observations for 1960, 1966 and 1973.

- For the analysis covering the post 1975 period, data collected by Cambridge Econometrics[10] is used. It provides annual figures on regional gross value added[11] on the NUTS II level for all 15 EU member states, and Norway.

The data sets are only used separately as the definitions of their indicators are not compatible. However, consistency of the data sets was checked and confirmed.

The data refers in general to NUTS II regions. However, for Ireland no regional data is available, as the country has not systematically collected statistics of regional income or output.[12] As, regarded by the size of population, Ireland is comparable with other NUTS II regions,[13] it has been included in the analysis. For Greece and Portugal there is no regional data available for the first periods of this analysis. As the development of cohesion countries is particularly interesting for EU regional policy, these countries were not dropped from this period´s sample. Country level GDP data has been used for the first part of the analysis. Although, the larger population size of these countries makes this practice more problematic than in the case of Ireland.

The Molle data, providing also figures for 1970, has been a principal data source for convergence analysis for this period, used also by Barro and Sala-i-Martin (1991, 1995) and Leonardi (1995). The restrictions reported, but moreover the supplement of country indexed indicators, had constituted an argument for Barro and Sala-i-Martin to confine their analysis to convergence within countries.

[8] This data set has been eleborated by Christian Vandermotten at the Université Libre de Bruxelles for Champion, Mønnesland and Vandermotten (1996). The author wishes to acknowledge kind permission to use the data set.

[9] The indicator is calculated from GDP in purchasing power parities.

[10] Cambridge Econometrics compiled this database for its regular report "European Regional Prospects". The author is particularly grateful to Cambridge Econometrics for permission to work with this extensive data set.

[11] The figures used are in constant prices, which were calculated by using sectoral country price indexes for deflationing.

[12] For several years in the 1960s estimates of regional income were elaborated (ESRI 1972), however not compatible with other EU regional data, but thereafter no further statistics were generated.

[13] The population of Ireland amounted to 3.571 mio. in 1994, whereas the population of NUTS II level regions was e.g.: Darmstadt (Ge) 3.7 mio., Oberbayern (Ge) 3.9 mio., Nord-Pas de Calais (F) 3.9 mio, Zuid-Holland (Nl) 3.2 mio., Andalucia (Sp.) 7 mio. , Puglia (I) 4 mio.

Throughout the paper it will be referred to regions composed in the following groups: EU-9, EU-12, the Southern cohesion countries, EFTA and Western Europe. EU-9 comprises all regions in the first nine EC member countries, i.e. the formation of 1973. EU-12 refers to all regions in EU-9 plus the regions from Greece (EC accession 1981), Spain and Portugal (EC accession 1986). Regions which belong to these latter countries constitute the group of Southern cohesion countries. The EFTA group regions comprise regions of Austria, Sweden, Finland and Norway (but not Switzerland, for which no data series are available). Finally, Western Europe includes all regions from the current 15 EU member states plus Norway.

4.2. The development of regional disparities in Europe, some stylized facts from the data sets

Before going into the analysis for β-convergence, we will look at the evolution of disparities in regional per capita incomes.

The evidence from country studies suggests, that during the 1950s mainly economies which had suffered most from the war had a high growth performance and quasi regained their pre-war income positions. In the 1960s, however, a strong diminution of income disparities was observed, a tendency which lasted until 1973. During this period initially high income countries (UK, Switzerland, Sweden) revealed average annual growth rates of about 3.1 per cent, middle income countries like France, Germany and Austria grew at about 4.5 per cent, and Europe´s low income countries Greece, Spain and Portugal - except Ireland - registered the highest growth rates of 6 per cent (Crafts and Toniolo, 1995, 6). As a result, on the country level income disparities sharply declined in the 1960-1973 period (Dunford 1993: 735).

At the European regional level, according to the data of Molle, income disparities declined considerably among the regions of EU-9 in the 1950s, and even more strongly during the 1960s. In 1950, the standard deviation of relative GDP p.c. was 36.4 per cent, it decreased to 33.2 per cent in 1960 and to 29.5 per cent in 1970. Hence, disparities declined by 8.9 per cent between 1950-60 and by 11.2 per cent in the following decade.

The figures are similar for the total set of Western European regions. The Vandermotten data set suggests that disparities among Western European regions declined by 10 per cent between 1960 -1966 and by 8.7 per cent between 1966-1973.

For the post 1975 period, for which we have annual data, we can trace the evolution of income disparities more precisely. Figure 1 shows the development of regional disparities in Western Europe, in EU-12 and EU-9, in the Southern cohesion countries, and in the EFTA. Disparities are measured as the standard deviation of relative GVA p.c. (with respect to the groups mean) in per cent. Since 1991, the data also includes the five new German Laender, which explains the general jump of disparities in 1991. Among EU-9 regions, after 1975 disparities had mounted again until 1981. However, after 1985 disparities declined distinctly and this tendency continued, even after the five new Laender joined. It is noteworthy that disparities among the EFTA regions are of much the same magnitude as in EU-9 and show a very similar pattern. After diverging until 1980, per capita incomes have continuously equalized throughout the eighties and early nineties in this group. Among the Southern Cohesion countries income disparities developed in a very different way. First, disparities are much higher than in the two wealthier groups, second, there is an opposite pattern. Disparities declined sharply until 1982, but have constantly grown since then.[14] One may even conclude that with the complete integration of this group into the European Community disparities have increased among its members. Certain regions have gained from integration, while others have stagnated. If we regard the whole group of EU-12 regions, disparities had an upward tendency until 1985[15], since then there seems to be a new path of decline, not accounting for the upward jump due to German unification. For Europe as a whole regional disparities show a decreasing tendency since 1980, if minor changes are disregarded.

For most parts of Europe, during the general slow growth period of the early eighties disparities increased again. With a more favourable growth climate in the late eighties the trend was reversed. The development among the regions of the EFTA group resembles that in the core EU-member group. Although their participation in the European integration process was formally limited, the EFTA economies have been closely linked in terms of trade with the Community (since the free trade agreements of 1973), which may explain a similar convergence path.

We may conclude, that income disparities in Western Europe have declined continuously since the 1950s, although in an interim period from 1975-1985 the

[14] Neven and Gouyette (1994) came to a similar conclusion on the development in the Southern cohesion countries and in the Northern member states as concerns the period 1980-1989.

[15] Dunford (1993) also shows on the basis of data from the Regio databank supplemented by country data that income disparities in EU-12 have risen in the period from 1975 until 1985.

decline seemed to have come to a halt. However, on the Southern fringe of the European Union some regions are obviously excluded from this development.

4.3. The convergence process of European regions: Results from a cross-section regression analysis on β-convergence

Following the methodology of cross-section regression analysis, we now wish to obtain an assessment of the convergence process for different groups of regions and for different periods in time. As outlined above, the issue is to look into the process of how income disparities decline. We wish to know whether regions in a group behave in the sense of β-convergence in order to assure that σ-convergence takes place. And we would like to know how fast convergence would have occurred.
The equation which was estimated in the regression analysis has the form:

$$1/T \cdot \log (y_{iT} / y_{i0}) = a - (1 - e^{-\beta T})/T \cdot \log(y_{i0}) + \gamma_n (\text{Country}) + u_{i0T} \qquad (7)$$

y_{i0} refers to the absolute (relative) per capita income at the beginning of the period, y_{iT} to per capita income at the end of the period, T is the length of the period. Hence the average growth rate of absolute (relative) per capita income in the period is considered. The parameter β indicates the speed of convergence. The intercept a is defined as $a \equiv x + [(1 - e^{-\beta T})/T] \cdot \log (y^*)$. The variable (Country) is a set of n country dummy variables and γ_n is the coefficient of the country dummy variable. The variable is introduced to account for differences in steady state. In some cases it proved useful to employ also a dummy variable for a particular group of regions, e.g. the objective 1 regions, to capture their steady state difference. Only those dummy variables are included in the estimation which are significant, non-significant ones are rejected. Hence we estimate for conditional convergence, but do not use other indicators than country/group of regions dummy variables as conditioning variables. This estimation uses non-linear least squares.

In order to find an appropriate division of the 1975-1994 period, covered by the annual data of Cambridge Econometrics, the growth rate series were examined. It turned out that the selection of the periods 1975-1980, 1980-1986 and 1986-1992 would best satisfy the criteria of similar cyclical paths across the regions. It also turned out to be important to account for the break in income disparities development, which occurred in 1975. Distinguishing between the pre and the post 1975 period provided a more differentiated result than Barro and Sala-i-Martin (1995: 398) had achieved, when analyzing the European data over each decade.

4.3.1. Regional convergence from 1950 to 1973

For the first two decades under consideration, we can find some quite impressive evidence of β-convergence among the regions of EU-9, which had lead to the decline of income disparities reported in the previous section. The estimation of the cross-section regression analysis yielded a speed of convergence, β, for EU-9 regions of 2 per cent in the 1950s and 3 per cent in the 1960s, both parameters have a high level of significance. The results of the estimations are reported in table 1. Both estimates have a rather high explanatory power of the relation, reflected by R^2 of 0.8 and 0.9. In this period the relationship between initial per capita income of a region and its growth rate is quite clearly negative (figure 2), except for the fact that Southern Italian regions seriously failed to fit in the general trend in the first decade. In the 1960s, Southern Italian regions stepped on the convergence train, showing growth rates of a magnitude which one would expect on the grounds of neo-classical growth theory with regard to their low initial income level. On the opposite, German regions in general had a higher growth performance in both decades. These obvious differences in steady states are captured by country dummy variables, reported in table 1. The negative sign of a dummy variable coefficient indicates a lower than average steady state income, and vice versa a positive sign. For the Italian South even a separate dummy variable was appropriate. In addition, growth rates in Ireland have been evidently below the general trend. Table 1 also shows that the UK regions in the 1960s became clear underperformers, as Ireland had been as well in both decades. It was mentioned above that the data for the 1960s of the Molle data set should be considered with caution for this analysis. Nevertheless the relation proves as firm that slight changes in data would not violate it.

Table 1: β- Convergence of EU-9 regions 1950-1970

	1950-1960		1960-1970	
intercept	0.1475	(5.58)	0.2340	(16.7)
β	0.0208	(4.01)	0.0326	(11.2)
γGe	0.0307	(10.80)	0.0119	(5.31)
γIt	-0.0076	(2.47)		
γIt-South	-0.0114	(2.62)		
γBe	-0.0179	(3.65)		
γNl			0.0089	(2.70)
γUk			-0.0342	(15.3)
γIr	-0.0152	(1.88)	-0.0203	(3.18)
R^2	0.79		0.90	
σ	0.0078		0.0063	
N	74		74	

Dataset: Molle
Note: t-values in parentheses

A next set of analyses based on the Vandermotten dataset allows to extent the investigation for regional convergence to different parts of Europe. For the period 1960 to 1973, β-convergence was estimated for the regions of EU-9, EU-12, the EFTA and a set comprising all Western European regions. Two subperiods were considered: 1960 to 1966 and 1966 to 1973. In contrast to the previous estimates based on the Molle dataset, the data now refers to the lower aggregated NUTS II level. More pronounced income differences, which appear on the less aggregated geographical level, have the effect to lower the convergence rate in the cross-section. Tables 2, 3 and 4 show the results of the estimates of β-convergence. Figure 3 illustrates the convergence process.

Looking at table 2, one can see that during the period 1960-1973 the group of EU-9 regions revealed a convergence speed of about 1.7 per cent p.a. However, regarding their regions together with those of Spain, Greece and Portugal, one notes that convergence of this group was higher, namely 2 per cent. Hence, the catching-up of the Southern European regions, which had broadly stayed apart from European integration, was rather satisfactory in this period. For the European regions as a whole, convergence was considerably lower, namely 1.5 per cent, due to a less satisfactory performance of some EFTA regions.

Table 2: β-convergence of European Regions 1960-1973 in various subsets

	EU-9 regions		EU-12 regions		EFTA-regions		Western European regions	
intercept	0.0760	(5.17)	0.0839	(6.72)	0.0272	(1.04)	0.0632	(5.51)
β	0.0174	(4.19)	0.0201	(5.55)	0.0059	(0.96)	0.0151	(4.99)
γGe	-0.0057	(2.49)	-0.0036	(1.71)				
γFr	-0.1205	(1.93)	-0.1284	(2.02)				
vFr	-0.022	(2.18)	-0.0239	(2.34)				
γIt							0.0054	(2.47)
γNl	-0.0063	(2.06)						
γUk	-0.0129	(4.34)	-0-0108	(3.77)			-0.0091	(3.40)
γIr	-0.0146	(1.77)	-0.0140	(1.66)				
γSp			0.0082	(3.15)			0.0126	(4.88)
γGr			-0.0380	(4.35)			-0.0315	(3.54)
γNo					-0.0101	(3.88)	-0.0111	(4.94)
R^2	0.44		0.60		0.20		0.51	
σ	0.0080		0.0082		0.0086		0.0084	
N	106		125		62		187	

Dataset: Vandermotten

Note: t-statistics in parenthesis, *vFR* is a slope dummy for France

A closer look on the two subperiods 1960-1966 and 1966-1973 (table 3 and 4) suggests that in fact, until 1966 the highest speed of convergence was registered by the group of EU-9 regions (2.8 per cent), only thereafter strong convergence emerged between the EFTA regions, and between the Southern countries´ regions, and in Europe as a whole. During the first half of the 1960s convergence did practically not exist among the EFTA regions (the β-coefficient is not significant), thereafter convergence had been very strong, namely 3.9 per cent. The regions of the Southern cohesion countries performed rather well in terms of per capita income growth, particularly since 1966. Their growth rates equalled those of other poorer parts in the European Community, namely the Southern Italian regions. Consequently regional convergence had comprised all European regions since the second part of the 1960s until 1973. The regional convergence rate had reached 2.8 per cent in total Western Europe, which was higher than among the core Community regions. Before, total European regional convergence lagged behind that registered in the Community.

Table 3: β-convergence of European Regions 1960-1966 in various subsets

	EU-9 regions		EU-12 regions		EFTA-regions		Western European regions	
intercept	0.1169	(7.61)	0.1156	(9.83)	0.0599	(1.11)	0.1020	(7.34)
β	0.0279	(7.22)	0.0258	(8.36)	0.0139	(1.04)	0.0242	(6.89)
γGe			-0.0065	(3.10)				
γFr	0.0072	(3.28)					0.0077	(2.92)
γIt	0.0066	(2.63)					0.0079	(2.84)
γNl	-0.0084	(2.96)	-0.0153	(5.21)			-0.0083	(2.33)
γBe			-0.0075	(2.50)				
γUk	-0.0106	(3.87)	-0.0175	(6.16)			-0.0105	(3.06)
γIr	-0.0197	(2.34)	-0.0254	(3.04)			-0.0175	(1.63)
γDk	0.0092	(1.92)						
γSp			0.0116	(4.60)			0.0195	(6.00)
γSwe					0.0059	(1.08)	0.0068	(2.67)
γNo					-0.0160	(3.49)	-0.0178	(6.14)
R^2	0.67		0.78		0.25		0.63	
σ	0.0080		0.0082		0.0140		0.0105	
N	106		125		62		187	

Dataset: Vandermotten

Note: t-statistics in parenthesis

Table 4: β-convergence of European Regions 1966-1973 in various subsets

	EU-9 regions		EU-12 regions		EFTA-regions		Western European regions	
intercept	0.1025	(5.39)	0.1141	(8.03)	0.1627	(4.81)	0.1198	(9.18)
β	0.0242	(4.94)	0.0270	(7.09)	0.0394	(3.91)	0.0285	(8.05)
γFr	-0.3341	(3.58)	-0.3457	(3.74)			-0.3514	(3.86)
vFr	-0.0585	(4.36)	-0.2883	(107.99)			-0.0609	(4.71)
γBe	0.0057	(1.63)						
γUk	-0.0076	(2.38)	-0.0086	(2.70)			-0.0087	(2.78)
γSwe					-0.0097	(2.66)	-0.0074	(3.21)
γFi							0.0066	(2.19)
γNo					-0.0211	(6.66)	-0.0154	(5.91)
R^2	0.33		0.41		0.57		0.47	
σ	0.0098		0.0098		0.0094		0 0097	
N	106		125		62		187	

Dataset: Vandermotten

Note: t-statistics in parenthesis, *vFR* is a slope dummy for France

The data analysis and the regression estimates reveal also some other interesting features of the countries´ steady state positions. Irrelevant in which group regarded, UK regions and Ireland had been clear underperformers in terms of per capita income growth throughout the period, which might be linked to their outside position from fostering economic integration in the Community. This was, however, not the case with Danish regions. The Dutch regions as well had a poorer growth performance compared to other EC regions and Europe in general. The Italian and French regions had an above average growth performance compared to other Community and European regions during the first part of the sixties. Among the Southern European countries, the Spanish regions clearly outperformed, which puts a sharp contrast to the performance of Ireland, that similarly started from a low income position. Among the EFTA regions, Norwegian regions showed poor growth throughout the 1960-1973 period.

In the case of French regions the data exhibits a tendency of regional divergence in the period 1966-1973. A slope dummy variable was used to cope with this peculiarity. Still, the French regions worsen the explanatory power of the regression estimate for EU-9. Regarding the explanatory power of our estimates, we should be satisfied if the fit of the equation is above an R^2 of 0.40. This is in line with similar estimations in the literature.

4.3.2. The equalization of European regional income distribution as a consequence of high pre 1975 convergence.

A look at the distribution of regional income in Europe confirmed that it had in fact become more equal in 1973 than it was in 1960. The occupation, both in the bottom and the upper income classes, had become lower.

The intra-distribution dynamics are shown in table 5.[16] Europe´s poorest regions (GDP p.c. below 60) in 1960, situated in the South of Italy and in the South, the Northwest and the centre of Spain, as well as Portugal and Greece had moved one group upwards on the GDP p.c. index classification or gained a significantly higher index number. On the contrary, Ireland practically had the same GDP p.c. index position in 1973 as in 1960. All other Spanish regions, found in the index group 60-80 in 1960, climbed to a higher index, often above 80. So did Northern Ireland and most of the Finnish regions.

[16] see also Champion, Mønnesland and Vandermotten (1996: 27) for shifts in regional GDP p.c. index between 1960 and 1973.

Other regions with below average GDP p.c. in 1960 (index 80-100), as regions in several parts of Germany, in the centre and Northeast of Italy and in Western Austria, also showed strong upward movements in index score. However, several other regions with below average GDP p.c., such as many Norwegian regions and the Southwest of France, dropped. In France one can observe a stagnation of peripheral regions in general, also several regions with an above average initial income level slightly lost. On the contrary the Ile-de-France became the second richest region after Hamburg.

Among the regions with an initial above average GDP p.c., several German, Swedish, British and Dutch regions lost in index score.

Table 5: Change in European regional income per capita distribution between 1960 and 1973: Occupation of index classes and movements between index classes

GDP p.c. index)	number of	number of	change between index classes	
(W.Europe=100)	regions in 1960	regions in 1973	up	down
> 160	4	2		2 to 140-160
				1 to 120-140
140-160	4	3	1 up to > 160	2 to 120-140
				1 to 100-120
120-140	23	16		9 to 100-120
				2 to 80-100
100-120	50	53	2 to 120-140	20 to 80-100
			1 to 140-160	
80-100	55	70	13 to 100-120	8 to 60-80
60-80	33	33	14 to 80-100	
			1 to 100-120	
40-60	13	11	7 to 60-80	
< 40	5	0	5 to 40-60	

4.3.3. Regional convergence from 1975 to 1994

Over the next two decades, the speed of convergence has considerably slowed down. Convergence continued at a slower rate in the period 1975-1980. From 1980 to 1986 it practically ceased. After 1986, it gained again the level experienced in 1975-1980.

A view on figure 4 shows that in the period 1975-1980 the negative relation between initial income and growth rates does not hold as properly. The graph

suggests that differences in country-specific steady states had become more pronounced. Table 6 shows the results of our convergence estimates for this period. Convergence does not differ much whether we regard EU-9 (1.2 per cent), EU-12 (1.4 per cent) or Western Europe as a whole (1.3 per cent). In the Southern countries, convergence to a group-specific steady state occurred at a speed of 2.5 per cent. Regions on the Iberian peninsula stopped to fit properly in a European convergence process, while most of the Greek regions continued their high growth performance from the past. Spanish and Portuguese regions had generally lower growth rates in this period. Similarly, among the European Community regions, weaknesses of convergence appeared in those regions, which later were defined as objective 1 areas. A specific dummy variable had to be defined for these regions for the regression estimates. The growth rates of UK and Dutch regions stayed below average as in the periods before, whereas German and North-Italian regions registered above-average growth rates. (The coefficient of Italy reported in the table is rather high, because it partly has to offset the Southern objective 1 regions coefficient). Performance of a part of the Norwegian regions had become extraordinary well due to starting exploitation of fossil fuels. They have been excluded from the sample for this period.

Table 6: β-convergence of European Regions 1975-1980 in various subsets

	EU-9 regions		**Regions in South. cohesion countries**		**EU-12 regions**		**EFTA-regions***		**Western European regions***	
intercept	0.1335	(2.91)	0.2062	(3.75)	0.1447	(6.06)	0.4373	(10.5)	0.1408	(6.79)
β	0.0118	(2.19)	0.0249	(3.35)	0.0132	(4.53	0.0508	(8.83)	0.0126	(5.04)
γGe	0.0059	(2.24)			0.0069	(2.42)			0.0053	(2.25)
γIt	0.0135	(4.32)			0.0140	(4.43)			0.0128	(4.52)
γNl	-0.0131	(3.69)			-0.0121	(3.18)			-0.0136	(4.04)
γUk	-0.0152	(6.04)			-0.0145	(5.54)			-0.0158	(7.08)
γObj-1	-0.0113	(3.63)			-0.0114	(3.59)			-0.0116	(3.95)
γSp					-0.0282	(8.84)			-0.0294	(10.18)
γP					-0.0254	(4.20)			-0.0261	(4.69)
γGr			0.0208	(3.76)						
γSwe									-0.0168	(5.73)
R^2	0.53		0.62		0.56		0.70		0.60	
σ	0.0105		0.0138		0.0114		0.0079		0.0105	
N	135		36		171		45		216	

Dataset: Cambridge Econometrics

Note: t-statistics in parenthesis, γObj-1 is a dummy variable for objective 1 regions (definition 1994) in EU-9 member states. * EFTA: Norwegian regions are not included

In the first part of the 1980s convergence across larger sets of regions hits the bottom. (see table 7) The β-coefficient which was estimated in the cross-section regression does not exceed 0.5 per cent and is only significant for the group of EU-9 regions. The estimated equations exhibit a particularly unsatisfactory fit in that period. Regarding figure 5, one notes that in each group two convergence paths seem to have emerged. Regions located in the same country have devided and can be found on both of these convergence paths. Among the EU-9 regions, UK regions showed a catching-up process. For the first time in the past decades they ranged among the highest growth performers among their Community partner regions. A part of the British regions, mainly those which benefited from North sea oil, can be found on the upper convergence path of EU-9, which was also joined by Southern German regions and Danish ones. The French and Italian regions generally had lower growth rates. The Southern Italian regions stagnated as in the period before.

Between the Southern cohesion countries´ regions as well, no common convergence path existed any more (see table 7). The convergence coefficient estimated is not significant. Portuguese regions had fallen seriously behind since 1980, some of the Spanish and Greek regions showed a distinctly better performance than others of the same country, in particular tourism-oriented regions outperformed (this was captured with a dummy variable). As figure 5 suggests EU-9 regions and the Southern regions which had just entered the Community or were going to do so, hardly had any convergence process in common.

Finally, as also the EFTA regions drifted apart, the coefficient of the estimated convergence equation for Western European regions changed its sign. The 1980-1986 period rather concludes with regional divergence in Western Europe than with convergence. If regional income distribution in Europe is compared between 1975 and 1986 (figures 6 and 7), one can recognize three peaks each on the below- and above-average index part in 1986, whereas there had been only two peaks on each side in 1975. This indicates that multiple levels of steady state incomes had emerged in Europe. Compared to the pre-1975 period, index classes on both the upper and the lower end show a higher occupation. The change of regional income distribution suggests that the phenomenon of club-convergence had occurred between 1975 and 1986. Club-convergence of rich regions could imply that some mechanisms of endogenous growth theory are at work.

Table 7: β-convergence of European Regions 1980-1986 in various subsets

	EU-9 regions		Regions in South. cohesion countries		EU-12 regions		EFTA-regions		Western European regions*	
intercept	0.0663	(2.57)	0.0549	(0.99)	0.0622	(2.35)	0.0835	(1.34)	-0.0037	(0.24)
β	0.0053	(1.82)	0.0053	(0.78)	0.0048	(1.61)	0.0064	(0.95)	-0.0019	(1.17)
γGe										
γFr	-0.0085	(4.95)			-0.0088	(3.98)			-0.0042	(2.23)
γIt	-0.0058	(3.19)			-0.0060	(2.59)				
γBe	-0.0086	(3.57)			-0.0088	(2.86)				
γLu									0.0112	(1.36)
γUk									0.0087	(5.56)
γDk	0.0064	(1.53)							0.0111	(2.31)
γP			-0.0113	(1.56)	-0.0147	(2.93)			-0.0101	(2.20)
γGr									0.0048	(1.68)
yTour			0.0223	(3.65)						
γCohes					-0.0080	(2.77)				
γA							-0.0167	(2.50)		
γFi							-0.0084	(1.77)		
R^2	0.25		0.36		0.18		0.12		0.22	
σ	0.0071		0.0125		0.0091		0.0143		0.0082	
N	134		35		169		62		214	

Dataset: Cambridge Econometrics

Note: t-statistics in parenthesis, , *γCohes* is a dummy variable for the S. cohesion countries, *γTour* is a dummy variable for highly tourism oriented regions in Southern cohesion countries. Two regions were dropped from the sample: Flevoland (Nl) and Alentejo (P). * Norwegian regions are not included.

In the following period 1986-1992[17], regional convergence picked up again, but at a slower speed. Figure 8 suggests that a part of EU-9 regions, as in 1980-1986 had set off for a superior growth path and thus continued to diverge from the rest. Among the Southern Cohesion countries, regions partly fitted quite well into the common convergence paths, others had fallen off. At a smaller extent, EFTA regions as well had partly fallen off the convergence path. The results of the cross-section regression estimate of β (table 8) show that convergence among Western European regions reached 1.6 per cent. Ireland and the Spanish regions on the lower part of the income scale performed above average. So did Belgian, German and Austrian regions, but Finish and

[17] As regional growth rate slipped down in 1992/93 due to cyclical reasons the last sample period has been chosen to end in 1992 in order to avoid interference of different cyclical paths.

Norwegian regions fell behind. The coefficients of the country dummy variables show the differences in steady state of these countries´ regions (last column).

Table 8: β-convergence of European Regions 1986-1992 in various subsets

	EU-9-regions	EU-9 without German regions	Regions in 4 cohesion countries and Mezzo-giorno	EU-12 regions	EFTA-regions	Western European regions
interce	0.1314	0.2077	0.1395	0.1308	0.2348	0.1538
pt	(3.11)	(3.97)	(3.13)	(5.27)	(4.77)	(7.78)
β	0.0126	0.0220	0.0140	0.0129	0.0254	0.0157
	(2.54)	(3.42)	(2.44)	(4.39)	(4.22)	(6.66)
γGe	0.0045			0.0079		0.0087
	(1.74)			(3.28)		(4.19)
γIt		-0.2471		0.0049		
		(2.87)		(1.81)		
vIt		-0.0254				
		(3.15)				
γNl	-0.0054					
	(1.60)					
γBe	0.0075	0.0090		0.0108		0.0109
	(2.05)	(2.86)		(2.98)		(3.29)
γUk	-0.0045	-0.0030				
	(1.93)	(1.41)				
γIr	0.0278	0.0272	0.0314	0.0310		0.0305
	(2.61)	(3.01)	(2.60)	(2.84)		(3.01)
γSp			0.0093	0.0092		0.0080
			(2.15)	(2.97)		(2.85)
γGr			-0.0210	-0.0207		-0.0229
			((4.62)	(5.14)		(6.35)
γA						0.0082
						(2.35)
γFi					-0.0084	-0.0082
					(3.17)	(2.65)
γNo					-0.0072	-0.0083
					(3.16)	(3.07)
R^2	0.20	0.34	0.55	0.33	0.37	0.46
σ	0.0104	0.0086	0.0113	0.0108	0.0076	0.0100
N	135	104	45	171	62	233

Dataset: Cambridge Econometrics

Note: t-statistics in parenthesis, *vIt* is a slope dummy for Italy.

Among the EU-9 regions, convergence in 1986-1992 was slightly slower, with β reaching 1.3 per cent. One can notice that in particular German regions have moved to a superior growth path as mentioned above, while Southern Italian regions have fallen off, with the result of a divergence pattern within Italy (shown by a negative slope dummy). Convergence was re-estimated excluding the German regions. The rest of the EU-9 group then reveals a convergence coefficient β of 2.2 per cent. In both estimates Belgian regions and Ireland have a better performance, while British regions are below again.

Since 1986, the regional convergence process within the group of the four cohesion countries and the Southern Italian regions, which had become the main addresses of EU´s regional policy, is worth to be investigated separately. The regions of this group exhibit a convergence rate of 1.4 per cent to each other. Ireland and Spanish regions have moved away in their steady state income from the group´s average in this period, while that of Greek regions has seriously fallen back.

Convergence among all EU-12 regions together was of a similar order, with β estimated at 1.3 per cent (table 8). The estimate reflects the differences in performance described just above.

If one looks at regional income distribution in 1992 compared to 1986 (figures 7 and 9), it is evident that the re-emergence of convergence since 1986 has led to a more normal distribution of regional incomes. Club-convergence continues, but is no more as striking as in 1986. The lower end of the income distribution curve shows a higher occupation, largely due to the inclusion of the new German Laender since 1992.

4.4. An alternative assessment of the regional convergence process 1975-1994 in a cross-section time series analysis

Differences in regional steady state income obviously had become quite important since the 1980s. They seem to be no longer linked to characteristics of the country where the region is located. The conventional cross-section regression analysis, however, does not permit to estimate individual regional effects in conditional convergence at the full extent. Therefore, we wished to employ an alternative framework for estimation, which could provide a direct estimate for individual regional factors reflecting region-specific steady state differences. We estimated convergence again for the period 1975-1994, this time exploiting the whole time series information of each region. In this panel data framework, individual regional effects, conditioning region-specific steady state income, can be estimated. The results will show that indeed region-specific

steady state incomes drifted apart, as we supposed in the previous section, particularly in the period when the speed of convergence, obtained in the cross-section regression, hit its bottom. When regions are bound to very different steady state positions, convergence to a common income level must lack.

The point of incomplete accountance of individual conditioning factors in conventional cross-section convergence analysis was also raised recently by Canova and Marcet (1996). However, one has to note that once region-specific effects in the conditional convergence analysis are fully accounted for, convergence will have a different meaning. Whereas convergence analysis traditionally assumed to identify groups of individuals, which each were characterized by the same size of a conditional variable, we now allow for continuous individual conditional effects. This implies that each region is converging towards its own steady state. Hence the convergence coefficient will be higher than in the cross-section analysis.

Region-specific effects can be modelled by employing panel data estimation techniques. We now consider the annual time series of GVA p.c. of each region over the period 1975 to 1994.

The basic equation, which captures the convergence process, then is:

$$\ln y_{i,t} - \ln y_{i,t-1} = a_i - b * \ln y_{i,t-1} + \lambda_t + u_{i,t} \qquad (8)$$

The equation states that the growth rate of GVA p.c. is negatively related to the level of GVA p.c. This is the original convergence relation explained in section 2.4. Regions are expected to exhibit a higher growth rate when their income level is low, but it should decline when income raises. This relation is presented by the common coefficient b. It should be noted that the convergence coefficient b differs from ß, the speed of convergence, which can only be established if we consider a period of time. Instead of a common intercept, we allow for individual intercepts and have to model a time-spcific factor to capture time-specific disturbances in the time series. Hence one gets a two way fixed effects model, in econometric terms. The individual intercept a_i constitutes the individual region-specific fixed effect, which is assumed to rule in the whole sample period. (The alternative assumption of random individual effects had to be rejected) It reflects the region-specific steady state income y_i^* according to the following relation:

$$\ln y_i^* = a_i / b \qquad (9)$$

(similarly to the cross-section analysis, where the common intercept $a = x + (1-e^{-ß}) \ln y^*$).

Hence the region-specific fixed effect a_i captures all conditional factors for the region´s steady state attributable to variables which we do not observe in this paper, or which are unobservable. The term λ_t represents a time-specific effect at period t which is the same across the whole section, it accounts for period-specific fluctuations in business activity. We eliminate the time-specific effect by considering the deviation of the variables from the period´s mean: $y_{i,t} - \overline{y_{.,t}}$, from now on.

For the estimation of this fixed effects model, ordinary least squares can be applied (Hsiao 1986). The estimations cover the same periods as in the previous section: 1975-1980, 1980-1986, and 1986 -1992.

This alternative estimation leads to striking results, summarized in table 9. Overall, growth rates are significantly negatively related to income levels, showing that the convergence relation holds true. The region-specific fixed effects, for which we report only minimum and maximum values as 235 fixed effects would have to be listed, are highly significant in most cases, and the explanatory power of the estimation is much better than of the estimations of the last section .

The convergence coefficient b for the whole period 1975-1994 (not reported in the table) is 0.19. Again, as indicated above the coefficient b is not comparable with β! The scale of our estimated coefficient b lies in a similar, higher range than β, as reported by other studies using similar specifications (e.g. de la Fuente 1996, Garcia Greciano et al. 1995). The convergence coefficient b estimated is particularly high in the 1980-1986 period, namely 0.56. However, as region-specific fixed effects are much more dispersed in this period than before, this indicates that regions showed strong convergence towards now more dispersed, specific steady state incomes. These results are consistent with those of the previous section, where hardly any convergence could be detected particularly for the period 1980-1986, but also for the one following. The low speed of convergence, constated in the last section, simply reflects the fact that conditional factors had become very pronounced, but we could not take this duly into account. Recalling equation (9), we can follow that steady state incomes of European regions had considerably drifted apart. Figure 10 depicts as an example the period 1980-1986 and plots the individual region-specific fixed effects against GVA p.c. in 1980. There evidently is a close relationship between the individual effects and the initial income position. Regions with initial high per capita income exhibit higher fixed effects and hence a higher steady state income. On the opposite, low income regions show large negative fixed effects and consequently a low steady state income to which they are converging. The graphs for the other periods estimated (not included here) show

the same pattern. It is particularly concerning that on the lower end individual effects show a stronger deviation since 1980 which remained thereafter. This leads to the conclusion that Europe´s poorer regions are locked in a low income position, whereas rich regions maintain their position.

Table 9: Panel data estimation of convergence 1975-1994

sample period	b	s.e.	t-value	R^2	s.e.of regress.	a_i min	a_i max	s.d. a_i
1975-80	0.19463 8	0.02557 0	7.61207 7	0.44294 6	0.02743 0	-0.284346	0.31229 1	0.08527 2
1980-86	0.56033 4	0.02650 1	21.1437 6	0.37060 2	0.03415 4	-0.835302	0.67559 7	0.24186 2
1986-92	0.45800 6	0.02030 1	22.5606 0	0.34946 4	0.03374 3	-0.772812	0.53056 5	0.19410 8

Dataset: Cambridge Econometrics
The estimated equation is: $\ln y_{i,t} - y_{i,t-1} = a_i - b * \ln y_{i,t-1} + u_{i,t}$, estimated for fixed effects with OLS, no. of regions 235, b is the convergence coefficient, a_i are region-specific fixed effects. The data comprises annual time series.

However, what is beyond the scope of this paper, but remains to be shown, is the question which factors are responsible for the increase of differences in region-specific steady state incomes observed in the last decade.

Finally, we can show how a low β-convergence, respectively the increase in the range of individual effects is reflected in changes in regions´ income ranking (table 10).

Table 10: Changes in the index position of relative GVA p.c. of less developed regions 1975-1994

relative GVA p.c. index class (W. Europe = 100)	number of regions in the index class 1975	change 1975-1994		
		1975-1986		1986-1994
60-80	23 (8 Sp, 7 It, 3 Uk, Ir, 3 Be, 1 A)	2 raised to class 80-100 (It) --	>	raised/dropped
		10 raised (Sp, It, Ir, Uk, Be, A)-	>	6 raised (Ir, Uk, Be, A) dropped (It, Sp, Uk)
		11 dropped (It, Sp, Uk, Be) ---	>	4 raised (Sp) 7 dropped (It, Uk, Be)
40-60	12 (6 Sp, 4 Gr, 2 It)	1 raised to class 60-80 (It) ----	>	dropped
		2 raised (Sp, Gr) ---	>	dropped
		2 dropped to class < 40 (Gr) --	>	dropped
		7 dropped (It, Sp, Gr) ----	>	dropped
< 40	15	1 raised to class 40-60 (Gr) ---	>	raised
		7 raised (Gr) ---	>	dropped
		7 dropped (P, Gr, Sp) ---	>	2 up to class 40-60 (Sp, P) 3 raised (P) 2 dropped (P, Gr)

note: based on Cambridge Econometrics data

As far as the development of Europe´s less prosperous regions is concerned, one has to note that there is mixed evidence of a continuous catching-up since 1975. Table 10 indicates the number of regions which occupied the lower GVA p.c. index classes in 1975, and traces their development in the following two decades. In particular, the Greek and several Southern Italian regions exhibit no continuous development. The Greek regions dropped back in index score after 1986, whereas a part of them had climbed up from 1975 to 1986. For the Southern Italian regions the same applies. The Spanish regions as well, exhibit no continuous development. Some of the Spanish regions dropped in index score until 1986 and consequently climbed up, others had climbed up, but dropped again after 1986. There are few constant upward performers since 1975, one of them is Ireland.

5. Conclusions

Regional convergence did take place, both, among the European Union regions, and between regions inside and outside it. The speed of convergence has declined over the past forty years and one has to realize that it is much too low in order to effect an equalization of regional income disparities in a reasonable time. At the current speed of convergence it would take nearly 50 years until a region may have eliminated half of its income gap.

There is no convincing evidence that integration into the European Union has spurred convergence of a region, as neo-classical theory would predict. For example, British regions and Ireland did not close their backlog in convergence after EC accession. Both had jumped on the convergence train only after 1980, several years after their entry, and deeper economic integration may not be the only explanation for their better growth performance since then. Similarly, some of the Southern European regions, which entered the Community in the course of its Southern enlargement, stepped on the trace of the Community convergence path, others did not.

In general, regional convergence was only more pronounced inside the European Union in its initial stage. Since the late sixties until 1980, convergence was as fast between regions inside the Union and between those inside and the ones outside the Union, if we neglect the interruption of the early eighties. However, both the EFTA regions and the Southern countries´ regions reveal also strong intra-group convergence. The EFTA regions since 1966 without a break, the Southern countries´ regions only until 1980, when diverging developments started in this group. From the perspective of a reduction income differences between the lower end and the upper end regions, it is particularly irritating that during the past 20 years convergence has become stronger between the Northern EC regions and the similarly wealthy EFTA regions.

During the first part of the eighties, regional convergence gave way to divergence. Only between the Northern Community regions a slight convergence process continued. For the total of European regions convergence had ceased. During this period club-convergence emerged in each group, which did not completely disappear when general convergence set in again after 1986. In addition, regional steady state incomes have drifted apart since the early 1980s. This suggests that factors described by endogenous growth theory have become relevant. Particularly, if one considers the superior growth performance of a set of fairly wealthy Northern EU regions, human and physical capital certainly must have had increasing returns in this places. The unequal

performance of EU´s Southern regions in the recent convergence periods proposes as well, that determinants of endogenous growth theory and structural adjustments have been at work. This opens the terrain for further research, which should, particularly for EU´s Southern regions, find an answer to what determined their unequal performance in convergence.

This paper did not address the question at which extent EU´s regional policy might have contributed to convergence. Such an investigation requires a different methodological framework. As EU´s regional policy had gained considerably in importance and effectiveness since the mid-eighties, which can be seen from the surge of structural fund spendings, one may expect that regional policy had a positive impact during the stronger convergence period after 1986. It might have contributed, together with a more favourable growth climate to resurgence of convergence.

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Figure 1: Regional disparities in Europe 1975- 1994:
Standard deviation of GVA p.c. froms the group´s mean, in per cent

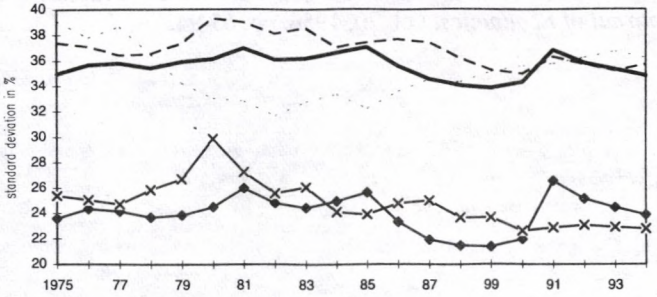

Figure 2: Regional convergence in EU- 9 1950- 1960: Average annual growth of GVA p.c. 1950- 60 versus GVA p.c. 1950

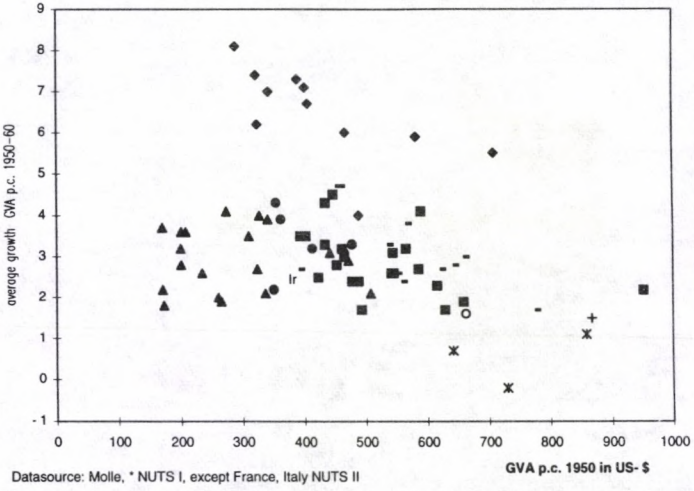

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Figure 3: Regional convergence in EU- 12: Average annual growth of GDP per capita 1960- 73 versus initial income

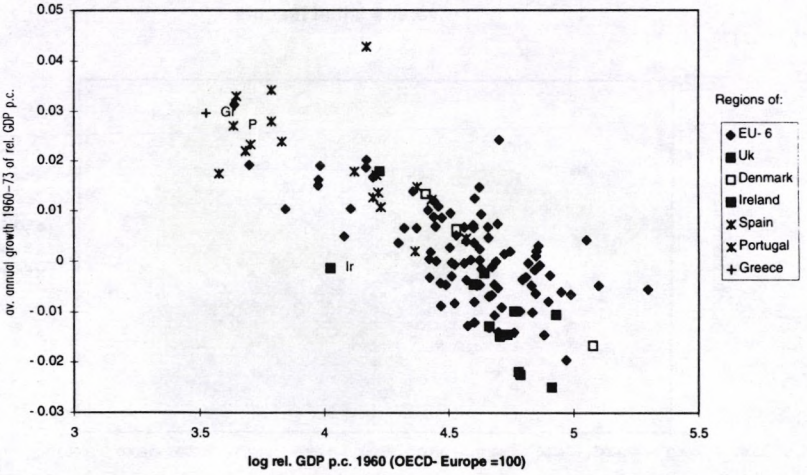


Figure 4: Regional convergence in Western Europe 1975- 1980: Average annual growth of gross value added per capita versus initial income

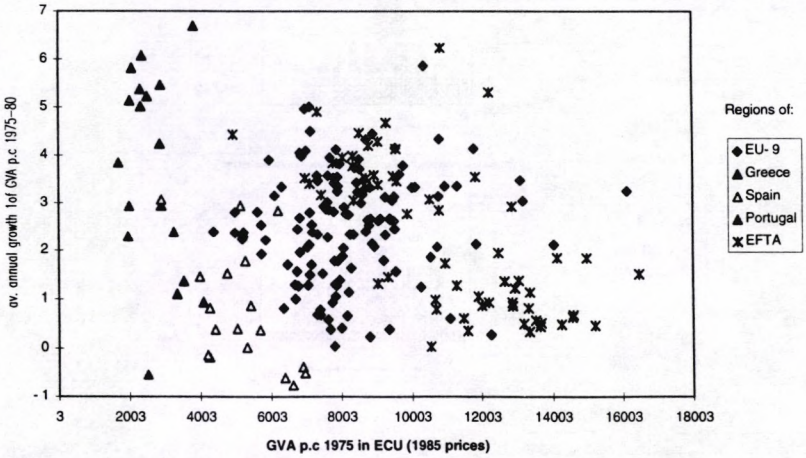


Figure 5: Regional convergence in Western Europe 1980- 1986: Average annual growth of gross value added per capita 1980- 86 versus initial income

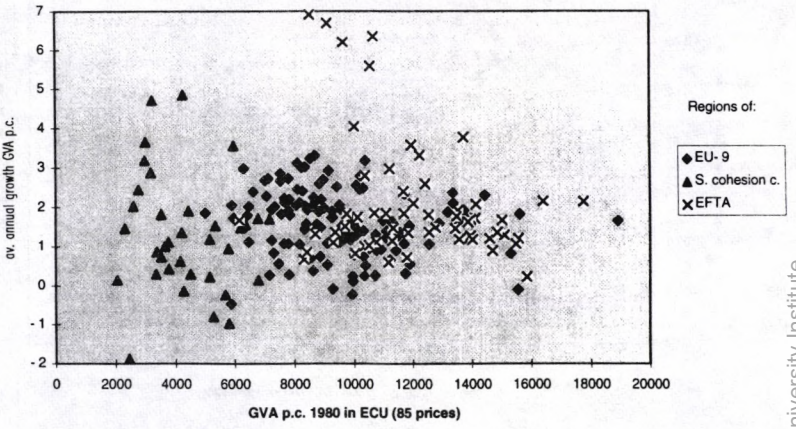


Figure 6: Distribution of regional GVA p.c. in Western Europe in 1975

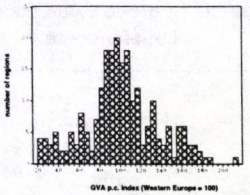


Figure 7: Distribution of regional GVA p.c. in Western Europe in 1986

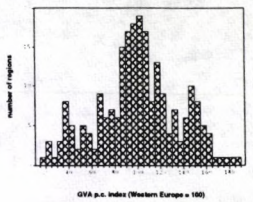


Figure 8: Regional convergence in Western Europe 1986- 1992: Average annual growth of gross value added per capita 1986- 92 versus initial income

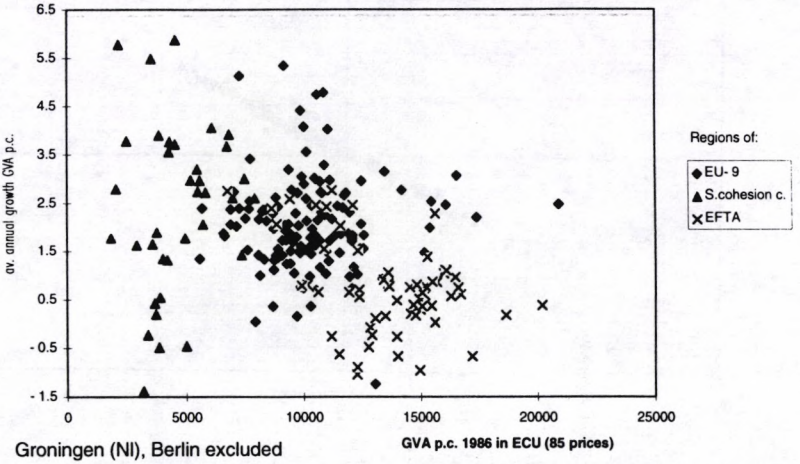


Figure 9: Distribution of regional GVA p.c. in Western Europe in 1992

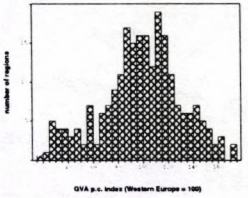
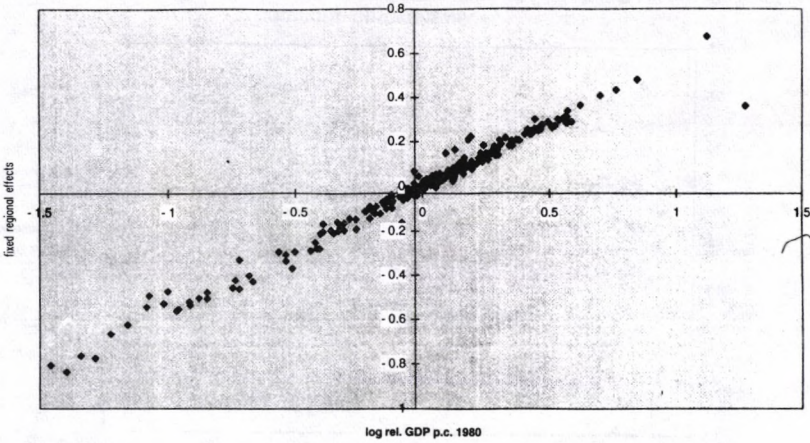


Figure 10: Convergence of Western European regions 1980- 1986: Fixed regional effects versus inital income position



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